Attachment E.1. Appropriate Assessment

Attachment E.1. contains the Screening Statement for the former Finisklin Landfill and Proposed Remediation Works, prepared in January 2012 by Dr. Brian Madden of Biosphere Environmental Services.

SCREENING STATEMENT

FOR

FORMER FINISKLIN LANDFILL AND PROPOSED REMEDIATION WORKS

JANUARY 2012

Prepared for

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1.0 INTRODUCTION

Sligo County Council is applying to the EPA for a certificate of authorisation for the former Finisklin Landfill in accordance with the requirements of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations, 2008. The application procedure requires the applicant to complete Stage I Screening for Appropriate Assessment in accordance with the requirements of Article 6(3) of the Habitats Directive (92/43/EEC).

This report therefore comprises a Screening Statement to determine the potential impacts, if any, of the former landfill and the proposed remediation measures for gas venting on the conservation status of nearby sites with European Conservation designations (i.e. Natura 2000 sites).

1.1 Regulatory Context

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna better known as "The Habitats Directive" provides the framework for legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (2009/147/EEC) (better known as "The Birds Directive").

Article 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect Natura 2000 sites (Annex 1.1). Article 6(3) establishes the requirement for AA as follows:

> "*Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implication for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*"

The Habitats Directive promotes a hierarchy of avoidance, mitigation and compensatory measures.

1. First the project should aim to avoid any negative impacts on European sites by identifying possible impacts early in the planning stage, and designing the project in order to avoid such impacts.
2. Second, mitigation measures should be applied, if necessary, during the AA process to the point, where no adverse impacts on the site(s) remain. If the project is still likely to result in adverse effects, and no further practicable mitigation is possible, then it is rejected.

3. If no alternative solutions are identified and the project is required for imperative reasons of overriding public interest (IROPI test) under Article 6 (4) of the Habitats Directive, then compensation measures are required for any remaining adverse effect.

1.2 Methodology

This report has been undertaken in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (EC 2001) and the European Commission Guidance 'Managing Natura 2000 Sites'. The Guidance for Planning Authorities entitled Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities' (Department of Environment, Heritage and Local Government December 2009, revised February 2010, www.npws.ie) is also adhered to.

In complying with the obligations under Article 6(3) and following the above Guidelines, the approach to screening is as follows:

- Description of the Project;
- Identification of Natura 2000 sites potentially affected;
- Identification and description of individual and in combination or cumulative impacts likely to result from the Project; and
- Assessment of the significance of the impacts identified above on the integrity of sites. Exclusion of sites where it can be objectively concluded that there will be no significant effects.

1.2.1 Field visit

A site visit was carried out on 22nd November 2011. This comprised a low tide inspection of the sediments below the former landfill to a distance of c.100 m from the rock armour. Sediment type and associated macro-invertebrate fauna was noted. At intervals, sediment was overturned using a trowel to a depth of c.20 cm and visually examined for macro-invertebrates. Along the fucoid covered shore, clumps of algae were moved aside and some rocks overturned (then replaced) to examine invertebrates present.

Observations were then made of bird activity in the area over a four hour period from the period of low/mid tide to high tide (3.9 m tide, 15.08 hrs). Observations were made from a discreet position on the rock armour on the north-western side of the sewage plant infill. From here, good views were available of a large area of the inner harbour, including the shoreline west of the former landfill location and extending west towards Dorrins Strand. Any bird activity in the immediate study area was recorded, as was general activity in the wider harbour. Observations were aided by use of good quality binoculars and a telescope.

1.2.2 Desk review

Analysis data from the detailed environmental assessment completed by Malone O' Regan in accordance with the EPA's published Code of Practice (CoP): Environmental Risk Assessment for Unregulated Waste Disposal Sites (2007) for the former landfill has been reviewed, along with data from various monitoring schemes for water quality in Sligo Harbour.

Sligo Harbour has been surveyed as part of the Irish Wetlands Bird Survey (I-WeBS) since the monitoring scheme commenced in 1994/95 (Crowe 2005). For survey purposes the intertidal flats off the former landfill are in the Cummeen Strand East and Gibraltar subsite. Data for this subsite and the entire Sligo Harbour complex for the period 2005/06 to 2009/10 were acquired for review from BirdWatch Ireland.

Ecological data for Sligo harbour, including sediment classification, are available from recent work in association with the proposed Sligo Airport Runway Reconfiguration project (planning application ref. no. PL 08/632).

2.0 DESCRIPTION OF LANDFILL AND PROPOSED REMEDIATION MEASURES

The former Finisklin Landfill is a closed landfill located on the outskirts of Sligo Town. The former landfill covers an area of approximately 13 hectares (ha) on the southern shores of the Garavogue River estuary approximately 1.5km north west of Sligo City Centre.

It is bordered to the north by Sligo Harbour and a new Wastewater Treatment Works (WWTW), to the east by commercial/industrial facilities located on Deepwater Berths Road, to the south by commercial/industrial facilities and to the west by Finisklin Road and a cul-de-sac in an area known as Far Finisklin. The regional location of the former landfill is shown on Figure 1, Appendix I while the extent of the former landfill for the purpose of this assessment is shown in Figure 2.

Historically landfilling at Finisklin commenced in 1958 and ceased in 1994. It would appear that historically (between 1958 and 1977) waste materials were also deposited beyond the boundary of the former landfill to the south and east. However, this land, which is now partially built over falls outside the scope of the present assessment.

The northern portion of the site, above the estuary, was the last to be filled. The seaward side of the site is protected by substantial rock armour works. Part of the former landfill boundary is now merged with the new WWTP site, which is built on ground infilled during the 1980s.

The former landfill was used for the disposal of domestic wastes and commercial and industrial wastes during its operational lifespan. Large amounts of C&D type fill material (clays, soils, stones, bricks, blocks, etc.) were deposited in many parts of the former landfill. The available information indicates that the maximum thickness of the waste body is 6.0m, with the capping layer ranging in thickness between 0.1m and 3.6m. It is estimated

that the approximate total tonnage of waste materials deposited in the former landfill was 625,000 tonnes.

Waste material was directly deposited onto existing mudflats. There was no landfill infrastructure installed during filling (e.g. gas or leachate collection systems).

As detailed elsewhere in the application documentation, a detailed environmental assessment has already been completed in accordance with the EPA's published Code of Practice (CoP): Environmental Risk Assessment for Unregulated Waste Disposal Sites (2007).

Based on the findings of these detailed assessments, recommendations have been made in regards to remedial works that would need to be undertaken at the site. These relate to landfill gas and consist of a vent trench along the northern end of the eastern boundary and a vent well system at the northern part of the western boundary. Some minimal works to the capping layer are also required. The proposed remediation measures are detailed on Figure 3, Appendix I.

Aside from the above remediation recommendations which will be screened in this report, a Source-Pathway-Receptor (SPR) linkage was found to remain with regard to the former landfill which is relevant to this assessment. This is the seepage of leachate to the protected sites via a surface water pathway. Notwithstanding this, it is noted that no specific remediation measures have been deemed necessary in the detailed environmental assessment. This will be further discussed in detail in Section 6.0 of this report.

3.0 CONSERVATION DESIGNATIONS RELEVANT TO SLIGO HARBOUR

Sligo Harbour is an area of international conservation importance and is designated as follows:

3.1 Cummeen Strand/Drumcliff Bay (Sligo Bay) (SAC) (code 000627)

This large site encompasses Sligo Harbour and adjoining Drumcliff Bay. Of relevance to the present study is that the boundary extends to the rock armour below the former landfill and includes all of the adjoining intertidal and estuarine habitats in the inner part of Sligo harbour. The site is selected for the following Annex I habitats and Annex II species of the EU Habitats Directive:

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Embryonic shifting dunes [2110]
- Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120]
- Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]
- Juniperus communis formations on heaths or calcareous grasslands [5130]
- Petrifying springs with tufa formation (Cratoneurion) [7220]
- Vertigo angustior [1014]

- Common seal (Phoca vitulina) [1365]

The habitats relevant to the present assessment are 'Estuaries' and 'Mudflats and sandflats not covered by seawater at low tide'. Consideration is also given to possible impacts on the Common Seal population.

A Conservation Plan for the SAC site has yet to be prepared by the Department of Arts, Heritage and the Gaeltacht. However, the following generic conservation objectives apply to the site:

> **Objective 1**: To maintain the favourable conservation status of the Qualifying Interests of the SAC (as listed above).
>
> **Objective 2**: To maintain the extent, species richness and biodiversity of the entire site.
>
> **Objective 3**: To maintain effective liaison and co-operation with landowners, legal users and relevant authorities.

3.2 Cummeen Strand SPA (code 004035)

Cummeen Strand SPA includes the entire estuarine component of Sligo Harbour. Of relevance to the present study is that the boundary extends to the rock armour below the former landfill and includes all of the adjoining intertidal and estuarine habitats in the inner part of Sligo harbour. The site is selected for the following Special Conservation Interests:

- Light-bellied Brent Goose (Branta bernicla hrota) [A046]
- Oystercatcher (Haematopus ostralegus) [A130]
- Redshank (Tringa totanus) [A162]
- Wetlands & Waterbirds [A999]

All of these interests are relevant to the present assessment.

A Conservation Plan for the SPA site has yet to be prepared by the Department of Arts, Heritage and the Gaeltacht. However, the following generic conservation objectives apply to the site:

> **Objective 1**: To maintain the favourable conservation status of the Special Conservation Interests of the SPA (as listed above).
>
> **Objective 2**: To maintain the extent, species richness and biodiversity of the entire site.
>
> **Objective 3**: To maintain effective liaison and co-operation with landowners, legal users and relevant authorities.

In addition, note is made of the following designations relevant to the wider Sligo Bay complex (though none of these would be expected to be affected in any way by the presence of the former Finisklin landfill):

3.3 Ballysadare Bay SAC (code 000622)

This is the southern of the three large inlets that comprise Sligo Bay. It is designated for a range of estuarine and coastal habitats, as well as the Annex II species *Vertigo angustior* and the Common Seal.

3.4 Ballysadare Bay SPA (code 004129)

This SPA is selected for populations of wintering Brent Geese, Grey Plover, Bar-tailed Godwit and Redshank, as well as for the general category of Wetlands and Waterbirds.

3.5 Drumcliff Bay SPA (code 004013)

This is the northernmost of the three inlets that comprise Sligo Bay. Its main reason for SPA designation is the internationally important population of wintering Barnacle Geese. It is also selected for the general category of Wetlands and Waterbirds.

4.0 DESCRIPTION OF STUDY AREA

The sector of the former landfill above the estuary is now well vegetated with a mix of rank, weedy vegetation, wet grassland and scrub (mostly willow) (see Plate 1). The edge of the former landfill is stepped towards the rock armour. The rock armour is continuous along the margin of the former landfill.

The lower strip of rock armour is inundated by the tide and is almost totally covered with brown fucoid algae (see Plate 2). Green algae (fine *Enteromorpha* species) occur on the boulders at the top of the tide line. Boulders occur scattered onto the shore where there is a narrow stony-gravel strip in places. The brown algae which cover the boulders and the extreme upper shoreline are mostly *Fucus spiralis* and *Fucus vesiculosus,* with *Pelvetia canaliculata* occasional on the upper boulders.

Intertidal sediments occur immediately below the fucoid zone. There is obvious accretion in the eastern corner as the sediments here are noticeably higher (and last to fill at high tide). The sediments are fairly uniform throughout the zone and are described as medium to fine sands. They are aerobic at the surface, with the anaerobic layer mostly one to several centimetres below the surface.

A substantial drain enters at the westernmost end of the rock armour (water brown/red tinted at time of survey), and there were several channels/seepages entering from the base of the rock armour (water clear) (see Plate 3).

The lugworm *Arenicola marina* is a common component of the infauna, with casts frequent throughout (see Plates 4 &5). The cockle *Cerastoderma edule* was also fairly widespread in the sands. The small gastropod *Hydrobia ulvae* occurs in localised patches, with scattered thin tellin *Angulus tenuis* and Baltic tellin *Macoma balthica*. Thin worm casts were probably those of *Pygospio elegans*. Mussels *Mytilus edulis* occur washed up attached to strands of fucoid algae of scattered rocks (a large mussel bed occurs c.500 m offshore north of Gibraltar Point).

Among the fucoid algae along the rock armour amphipods (*Gammarus* spp.) were common, along with shore crabs *Carcinus maenas*. The ragworm *Nereis diversicolor* was found beneath some rocks.

There was no presence of eelgrass (*Zostera* spp.) anywhere on the sediments in the study area.

The Aquatic Services Unit carried out a marine intertidal survey throughout Sligo harbour in June 2007 (for Sligo Airport Runway Reconfiguration project). Sampling station no. 21 (easting 166675.1, northing 337333.0) is within 500 m north-west of the study area, and sampling station no. 23 (easting 167170.2, northing 337770.4) is approximately 500 m west of the study area. Sediments at these stations were described as fine sands (89.5% and 87.4% percentage respectively). The infauna was similar at both stations and classified as part of a group characterised by the following: *Angulus tenuis, Hydrobia ulvae, Cerastoderma edule, Pygospio elegans, Macoma balthica, Arenicola marina* and *Capitella capitata*.

4.1 Discussion

The survey carried out by the Aquatic Services Unit considered that the intertidal communities of Sligo Harbour are typical of sandy/muddy sand coastal communities. Classification of the faunal groupings in relation to the JNCC classification indicated the presence of two distinct community types based on infaunal abundances and sedimentary data. These biotopes are as follows:

- LS.Lsa.MuSa.CerPo [Cerastoderma edule and polychaetes in littoral muddy sand]
- LS.Lsa.FiSa.Po.Aten [Polychaetes and Angulus tenuis in littoral fine sand]

LS.Lsa.MuSa.CerPo [*Cerastoderma edule* and polychaetes in littoral muddy sand] is known to occur in '*Extensive clean fine sand or muddy sand shores with abundant cockles Cerastoderma edule* (Connor *et al*. 2004), while LS.LSa.FiSa.Po.Aten [Polychaetes and *Angulus tenuis* in littoral fine sand] is described as occurring '*on the mid and lower shore on moderately wave-exposed and sheltered coasts, with predominantly fine sand which remains damp throughout the tidal cycle. The sediment is often rippled, and an anoxic layer may occasionally occur below a depth of 10 cm, though it is often patchy. The infaunal community is dominated by the abundant bivalve Angulus tenuis together with a range of polychaetes.*'

The intertidal sediments below the rock armour at the former landfill are considered to fit into the biotope LS.Lsa.FiSa.Po.Aten [Polychaetes and Angulus tenuis in littoral fine sand], with the frequency of polychaetes particularly notable.

While the intertidal zone below the rock armour appears normal and similar to other areas in the harbour at this shoreline level, the upper shore has been removed by infill. This would have been a fairly sheltered area with a higher mud fraction expected in the sediments. The shoreline would have been marked by a wide fucoid zone on stones and gravel and probably a salt marsh fringe (similar to what still occurs immediately to the west of the rock armour and leading towards Gibraltar Point – see Plate 6).

5.0 BIRDS

5.1 Population Trends in Sligo Harbour

As already noted, Sligo Harbour is an internationally important bird site on the basis of the Brent Goose population (average of 480 in 5 year period 2005/06 to 2009/10). In the same 5 year period, the following species had numbers of national importance: Oystercatcher (824), Knot (784), Dunlin (953) and Bar-tailed Godwit (429) (see Appendix II for full set of I-WeBS data).

The former landfill merges with a sector of the harbour that is within a large count sub-site that extends approximately to Cummeen (c.3 km west of the former landfill) and out to the central channel. This sub-site also supports an internationally important population of Brent Goose (average of 264 in 4 year period 2006/07 to 2009/10), and nationally important populations of Knot (804) and Bar-tailed Godwit (271) (see Appendix II for full set of I-WeBS data).

The Sligo Harbour data for the 2005/06 to 2009/10 period are compared to earlier data in Table 1.

Table 1. Waterbirds occurring in significant concentrations at Sligo Harbour for various periods (data from Crowe 2005 and I-WeBS).

Species	**94-98**	**95-99**	**96-00**	**05-09**
Light-bellied Brent Goose	228	239	299	460
Oystercatcher	537	634	731	824
Knot	<190	<190	<190	784
Dunlin	<880	<880	<880	953
Bar-tailed Godwit	<160	<160	<160	429
Redshank	525	499	504	292
Greenshank	21	20	19	10

The increase in the Brent Goose population in the 2005/06 to 2009/10 period is partly due to very high numbers (peak of 663) in one winter (2006/07). Oystercatcher numbers have increased substantially since the mid 1990s, while numbers of Redshank and Greenshank have declined. It is noted that populations of a further three species (Knot, Dunlin, Bar-tailed Godwit) achieved national importance in the 2005/06 to 2009/10 period but not in any of the earlier periods in the 1990s.

In the 1984/85 to 1986/87 Winter Wetlands Survey (Sheppard 1993), Cummeen Strand (or harbour) had two species with internationally numbers (Brent Goose 621, Ringed Plover 603), and one species, Redshank (396), with a nationally important population.

In the first national census of wetland birds, the *Irish Wetlands Enquiry* (winters 1971-72 to 1974-75), Hutchinson (1979) wrote of Sligo Bay: '*It seems likely that there is considerable movement of ducks and waders between these three estuaries (i.e. Ballysadare Bay, Cummeen Strand, Drumcliff Bay), but no simultaneous counts have been made. Instead, our knowledge of the birds of the area is based on a series of counts carried out at irregular intervals at each of the three main estuaries*'.

He noted that Cummeen Strand holds internationally important numbers of Brent Geese (sometimes over 2,000) and on occasions large numbers of Wigeon (c.2,000) and Mallard (several hundreds). He further writes: '*This is the best wader area in Sligo Bay and the most numerous species are Oystercatcher (up to 700 in late autumn), Ringed Plover (up to 200), Curlew (up to 300), Bar-tailed Godwits (up to 180), Redshank (up to 160) and Dunlin (up to 200).*'

Overall, there are more species wintering in Sligo Bay with populations of national importance than ever before, though several species, especially Ringed Plover and Redshank, have declined substantially.

The above data extending back to the 1970s show how bird populations change over time. At a local level, major habitat changes, pollution or changes in the level of disturbance can cause population changes. However, such changes may not necessarily be due to local conditions in the wintering sites but may reflect changes on the breeding grounds or changing migration routes.

5.2 Usage of Intertidal Area beside the former landfill

No birds were present in the study area on arrival at low tide (LT - 08.54 hrs). By 11.30 hrs the tide was rising towards the former landfill though there were still very extensive expanses of intertidal sandflats available in the main harbour area and extending towards Dorrins Strand. Large numbers (many hundreds) of feeding birds were along the central channel and scattered on the open flats.

By 11.50 hrs, the tide was rising rapidly in the study area and by 12.00 hrs only a fringe of c.10 m was left uncovered below the rock armour (apart from the elevated eastern corner). This was c. 3 hours before high tide and extensive intertidal areas were still exposed in the main harbour area.

At 11.45 hrs, three Curlew and two Oystercatchers had flown in to the study area to feed along the rising tide. These remained for 10 to 15 minutes before departing towards the central area of the harbour.

By 12.30 hrs, all the intertidal sediments were covered apart from a small patch in the eastern corner.

At 12.55 hrs, a single Curlew flew in to the rock armour and could be seen feeding among the fucoid layer. This bird stayed for c. 10 minutes and then flew to the shore west of the rock armour.

By 13.00 hrs, all sediments were covered and the water was rising along the rock armour. Substantial areas of intertidal flats were still exposed in the central harbour area (c.2 hrs before high tide).

No further birds were recorded within the study area up to or after high tide (HT = 15.08 hrs).

5.3 Discussion

From the assessment of the sediment and associated infauna in the study area, it is considered that there is an ample supply of food items available for wintering waterbirds. Species such as *Arenicola marina, Cerastoderma edule, Hydrobia ulvae* and *Macoma balthica* are principal species that are taken by a range of wading birds (oystercatcher, curlew, redshank, etc.). Brent Geese and duck species such as Wigeon (both herbivorous) would be less expected in the study area as no noticeable growths of green algae were present and there is no salt marsh fringe.

From the survey it seemed obvious that the reason why so few birds were recorded within the study area was because the majority of birds were feeding out in the central part of the harbour where extensive intertidal areas were still exposed until about 14.00 hrs (whereas the sediments in the study area were essentially fully covered by 12.30 hrs). The central area of the harbour would probably offer more diverse feeding habitats and is also safer from potential disturbance. It is noted that the stretch of natural upper shore to the west of the rock armour was also used by only a small number of birds (curlew, oystercatcher, a few turnstones, grey heron and three mallard). It is possible that larger numbers may use the study area at other times during the winter, perhaps when the food resources in the main area of the harbour are more depleted.

There are no high tide roost sites within the study area.

Prior to the construction of the former landfill, the tide here would have taken longer to fill and birds would have had more feeding opportunities. Also, species such as Brent Geese could have been expected to feed along the original salt marsh fringe. The Ordnance Survey map indicates that the area would have had a suitable high tide roost by way of a salt marsh spit.

Whilst survey data are available for Sligo Harbour since the mid 1970s, these are not sufficiently detailed or focused to determine if there have been any population changes in the area that could be attributable to the presence of the former landfill. Further, apart from the former landfill other local developments would have influenced local distribution of birds.

6.0 POSSIBLE IMPACTS OF LANDFILL & PROPOSED REMEDIATION MEASURES ON ESTUARINE ENVIRONMENT

The impact of potential concern is seepage of leachate to the estuarine environment via surface water pathways, which can affect adversely the biological quality of the system. As components of leachate can biomagnify up the food chain, particular consideration is given to estuarine birds which are present on the estuary mainly from September to March. As the measurement of potential contaminants in the tissue of the birds is not feasible (and even if high concentrations of certain parameters were found these could not necessarily be linked to the former landfill as birds are highly mobile and utilise a range of sites), the assessment is therefore based on available information on the components or quality of the leachate entering the estuary, water quality and biota analysis data for the harbour, and population data on the birds of the harbour.

The proposed remediation measures will involve some excavation works to the existing waste body. The existing rock armour however will not be impacted on. Although the works will disturb the waste body, it is unlikely that the leachate currently seeping via surface water pathways to the harbour will change significantly in terms of quality or quantity. Nevertheless, further detail is provided below on mitigating factors such as the available attenuation within the Garavogue Estuary.

6.1 Characteristics of Leachate

One of the consequences of the disposal of wastes in landfills is the generation of leachate. The volume of leachate produced by a landfill is related to the in-place density of the refuse, decreasing from 50% to 15% of the yearly precipitation with increasing compaction of the waste (Stegman 1980). The concentration of various potentially polluting substances in leachate varies depending on a variety of factors such as the type of waste disposed of, water content, design and operation of the site, and the age of the waste.

Of particular environmental concern are organic contaminants. Many organic compounds which may be found in landfill leachate are of environmental significance in very low concentrations – parts per billion (ppb) or parts per trillion (ppt) quantities. Consequently very small amounts can cause severe pollution (Daly 1991). Of particular concern are compounds such as polychlorinated biphenyls (PCBs) which are hydrophobic, fat-soluble and biologically stable so that they accumulate in body fats. They also biomagnify along food chains and in some ecosystems concentration factors from water to top predators may be as high as 10 to the power of 7 (Mason 1996). For three decades, until the mid-1970s, PCBs were widely used in such things as transformers, capacitors, hydraulic systems, lubricating oils, and as sealants that fill gaps between concrete blocks in buildings. In 1973 their use started to be restricted, and they were totally banned across Europe in 1986

(Edwards 1997). McGovern et al. (2011) note that the detection of PCBs in the aquatic environment does not necessarily infer recent or indeed local inputs. They note further that sediments are long-term sinks for PCBs.

The sequence of microbiological breakdown processes which occurs in landfills is now well established, in that the landfill progresses through the anaerobic, acetogenic, methanogenic, and finally semi-aerobic phases. While these phases will ensure that organic matter is eventually completely broken down and the carbon is released in the form of methane and carbon dioxide gases, some of the end products of these degradation processes remain as soluble components of leachate. Thus, waste components which constitute pollutants in the solid phase are gradually transposed into a liquid phase and can only be eliminated from a landfill providing encapsulation by the removal and treatment of the leachate. Robinson and Gronow (1993) state that a large, deep, high-density domestic landfill, operated in a typical manner as at present in the UK, will continue to produce strong and polluting leachates well in excess of values considered acceptable for discharge to surface or groundwater for a large number of decades and possibly over timescales in excess of a century. The concept of very protracted time scales for leachate control is discussed in more detail by Belvi and Baccini (1989).

6.2 Leachate from the Former Finisklin Landfill

The former Finisklin landfill operated from between 1958 and 1994. The former landfill is not lined and there is no confining layer present to intercept the seepage of leachate to surrounding areas.

A detailed environmental assessment has been carried out by Malone O'Regan for the site (see report elsewhere for details). Surface water monitoring was conducted at four locations (SW1 to SW4) in July 2009, two of which were at low tide from two small seeps (outfalls) discharging from the northern boundary of the former landfill into the estuary from the toe of the retaining sea wall (SW1 and SW2). There was no direct discharge to the harbour that could be sampled. Two additional samples were collected from two on-site ponds (SW3 and SW4). Surface water samples were analysed for a broad range of potential contaminants and the analytical suite closely followed the parameters as set out in Table C.2 for the EPA Landfill Monitoring Manual (2003) for 'Surface Water Baseline'.

The analytical results indicated that groundwater and surface water have been impacted by a number of contaminant sources including waste materials from the former landfill, tidal intrusion and other sources. While it is not possible to pinpoint exactly which compounds are as a direct result of the former landfill it is reasonable to assume that the former landfill is a contributory factor to the elevated concentrations of a number of parameters observed in the groundwater and surface water samples.

Due to the location of the former landfill on an estuary, it is likely that the surface water seeps at the base of the former landfill embankment have been strongly influenced by tidal waters entering and leaving the landfill site as well as the leachate present within the former landfill body. Parameters that exceeded the relevant standards which are indicative of tidal influence include electrical conductivity, chloride, total dissolved solids, sodium, potassium and magnesium as they are typically elevated in seawater.

However, other parameters, not typically associated with either tidal influence or naturally occurring contaminants (with the exception of some metals), were also identified and include ammonia, MRP, total and faecal coliforms, boron, arsenic, nickel, manganese and iron. These contaminants may or may not reflect an impact from the former landfill at Finisklin as there are a number of other potential sources in the area.

The landfill material was sampled for PCBs. The reported concentrations were below the MDL for all samples except for the sample taken at TP10, which reported a concentration of 0.082mg/kg. However, this did not exceed the WAC for inert landfills of 1mg/kg. The low levels of PCBs in the area of the former landfill sampled is not surprising as usage of PCBs was in decline by the early 1970s and was banned in Europe in 1986 (though significant quantities remained in circulation). McGovern et al. (2011) note that in general PCB concentrations are low in Irish waters and have not been detected in seawater samples in monitoring schemes. In shellfish PCB concentrations are typically found to be higher close to urban/developed areas. Where significant temporal trends have been detected for PCB congeners they are invariably downwards and the outlook would be for these trends to continue, although given the environmental persistence of these substances they are likely to be detected for years to come.

For pesticides, reported concentrations of atrazine and simazine were below the laboratory MDL (1µg/l for both parameters) for all samples (leachate, surface water and groundwater). However, the MDL for atrazine was greater than the Surface Water Regulations, 2009 annual mean value of 0.6µg/l. McGovern et al. (2011) note that organochlorine pesticides (OCPs) have not been detected in Irish seawater samples above the laboratories reporting limit (with the exception of two single detections). OCPs are generally detected in biota but levels are low and within assessment criteria. When trends are detected, such as in mussels at Paddy's Point trend station in Cork Harbour, they are downwards and this downward trend would be expected to continue for these long regulated substances. However, due to environmental reservoirs (such as in sediments) and their persistence, their detection in the marine environment can be expected for many years to come.

The environmental assessment report states that there is considerable dilution capacity within the Garavogue Estuary water body. Taking this dilution capacity and the various baseline data into account (including water quality – see further detail below), the study concluded that although leachate is being generated at the former landfill, it is not significantly impacting (via groundwater and surface water pathways) on the quality of the receiving waters.

6.3 Water Quality of Sligo Harbour

The Sligo Harbour/Garavogue Estuary is extensively monitored and evaluated by a number of key stakeholders for different purposes (details are included in the detailed environmental assessment). Some examples include:

- Water sampling completed at various locations along the length of the River Garavogue and transitional waters as part of the operation of the WWTP.

- Shellfish mandatory and guideline values and monitoring. Shellfish mandatory and guideline values were not breached in any samples collected from 2004 to 2008. Although faecal coliform results indicated an exceedance in November 2008 and February, May and August 2009.
- Water Framework Directive (WFD) monitoring programme. The WFD status of the coastal water body, within which the outer part of the shellfish area is situated is classified as 'high'. The transitional water body within which the inner part of the shellfish area is situated as well as the Garavogue River itself that discharges to the shellfish area are both classified as 'good' and considered satisfactory (Western River Basin District, 2009).
- Water Quality in Ireland 2007-2008 – EPA document designates the Garavogue Estuary, Sligo Harbour and Sligo Bay as 'unpolluted'. Biological indicators are reported as 'good' for the Garavogue Estuary, and as 'high' for Sligo Harbour and Sligo Bay. Generally dissolved inorganic nitrogen and phosphorus were reported as being higher in the Garavogue Estuary when compared to Sligo Harbour or Sligo Bay, however the reported concentrations were still low. This report identified that groundwater up-gradient of the former landfill was contaminated with >100cfu/100ml faecal coliforms (EPA, 2009a).

The Marine Institute has recently published a detailed assessment of dangerous substances in Water Framework Directive transitional and coastal waters for 2007 to 2009 period (Marine Environment & Health Series, No. 38, 2011). Data are available for shellfish samples in Sligo Harbour for trace metals, chlorobiphenyls, cyclodiens, DDTs, hexachlorocyclohexanes and organochlorines (see Table 2 in above-mentioned report). All parameters were compliant with best available assessment criteria and the overall status of Sligo Harbour is given as good.

Overall, the various available water quality data for Sligo Harbour confirm that the water quality of the harbour is generally good with the exception of faecal coliforms.

6.4 Birds and Macro-invertebrates

From the visual assessment carried out for the present study it appears that the sediments and associated macro-invertebrate fauna of the area below the former landfill are typical of an Irish estuarine ecosystem. Expected invertebrate phyla are well represented, especially molluscs and annelids.

It is accepted that the sediments and macro-invertebrate fauna immediately below the former landfill may potentially have higher levels of some of the constituents of leachate than would otherwise be expected (as sediments can be long-term reservoirs of trace metals, pesticides etc.). Theoretically, potentially harmful substances could be taken up by birds (top of estuarine food chain) and bioaccumulate in their tissue. However, it is considered unlikely that contaminants derived from landfill leachate are causing a significant environmental threat, and especially a threat to birds, for the following reasons:

- The volumes within the former landfill of the contaminants of most concern, i.e. organics such as pesticides and PCBs, are likely to be low as the greater part of the

landfill was operated in the 1980s and 1990s when the use and disposal of such substances was either banned or strictly regulated. This fact is supported by the soil and waste sample results obtained by Malone O'Regan as part of their detailed environmental assessment of the former landfill.

- Contaminants reaching the estuary from the former landfill are subject to high dilution and dispersion by tidal waters.

- The baseline data from various monitoring studies on water quality and shellfish all indicate that the environmental quality of Sligo Harbour is generally good.

- For an individual bird to accumulate significant quantities of contaminants it would presumably need to be feeding regularly on the infauna in the immediate area of the former landfill (assuming there are contaminants in the various macro-invertebrate species in the first place). However, this is not the case as the sediments below the former landfill are only exposed for about half the period of low tide and do not appear to be a favoured feeding area (the very extensive intertidal flats of the central part of the harbour provide the main feeding area). Further, Sligo Harbour is only part of the Sligo Bay wetland complex and the wintering wetland birds of Sligo Harbour move readily between the other two bays (i.e. Ballysadare and Drumcliff) (Crowe 2005).

- While long-term baseline data on bird populations are not available for the Finisklin area of Sligo Harbour, recent data (since winter 1994/95) from I-WeBS indicate that Sligo Harbour continues to support important concentrations of wintering waterfowl. While fluctuations in numbers occur between winters, these are considered to be within the normal range of population fluctuations and overall there are now more species in Sligo Harbour with populations of national importance than there had been in the 1980s or mid 1990s. Declines in species such as Redshank since the mid 1990s could not necessarily be attributable to local conditions.

It is again noted that the scarcity of feeding birds in the area below the former landfill on the day of the survey is considered to be due to local tidal conditions (which have been altered by infill for the former landfill and the WWTP) rather than an impoverished infauna that could be attributed to effects from the former landfill.

7.0 IN-COMBINATION EFFECTS

The Habitats Directive requires that due consideration needs to be given to any plan or project which is likely to have a significant effect alone or in combination with other plans and projects.

The former Finisklin landfill is located in an area with a number of other potential sources of contaminated run-off to the estuary. However as noted in Section 6.3, and in the environmental assessment report, the water quality of the estuary has been designated as

"unpolluted." Accordingly, it is considered that the existing seepages from the former landfill are not impacting on water quality when considered in combination with other potential local sources. Additionally, it is noted that the proposed remediation measures for gas venting are not expected to alter or result in significant change to the volume or quality characteristics of the seepages. Accordingly the proposed remediation measures are not anticipated to result in changed in-combination effects with other local sources.

8.0 CONCLUSION

Despite the fact that there is a direct pathway between the leachate generated in the former landfill and surface water seeps, it is concluded that there is no evidence to suggest that the estuarine environment of Sligo Harbour is being affected adversely.

In particular, it may be stated that the presence of the former landfill, alone or in-combination with other projects, does not appear to be affecting the conservation objectives or the various qualifying interests of the Cummeen Strand/Drumcliff Bay SAC and the Cummeen Strand SPA, or indeed any other Natura 2000 site in the wider area of Sligo Bay. Accordingly, progression to Stage 2 of the Natura Impact Statement process is not considered necessary.

9.0 REFERENCES AND BIBLIOGRAPHY

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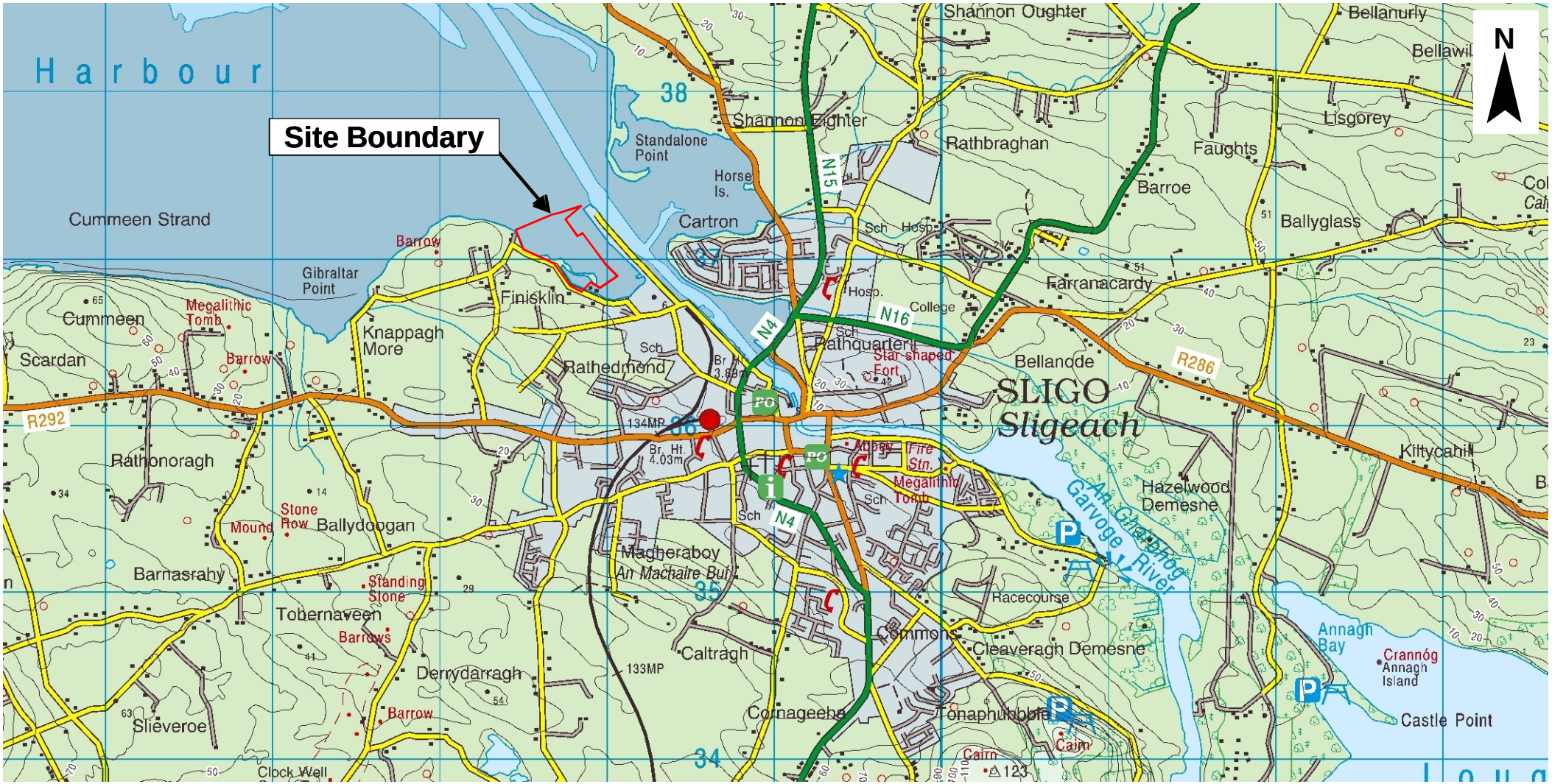
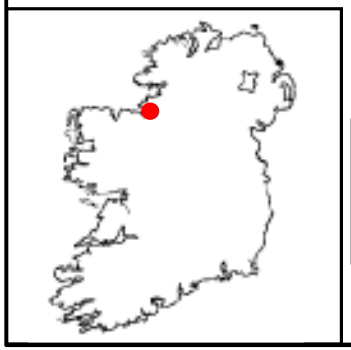
APPENDIX I

FIGURES





Legend:

Site Boundary

0m 500m 1000m

Ordnance Survey Ireland No. EN0002512© Ordnance Survey Ireland and Government of Ireland

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Client	Drawing
Sligo County Council	Regional Site Location
Job: Former Finisklin Landfill EPA Certificate of Authorisation Application- Screening Statement	

Job Number	Drawing Number	Status	Sht. Size	Scale	Date	Drawn
E0861	Figure 1	Final	A4	NTS	Jan 12	JA

LEGEND:

Boundary within Ownership of Sligo County Council

N

Deep Water Jetty

Boro Co Bdy

UND

Tanks

W.B

H/M

Barytes Jetty

MUD

Navigation Post

Tank

Tanks

Navigation Post

Mud

Duncans Island Business Centre

Industrial Estate

0m 50m 100m

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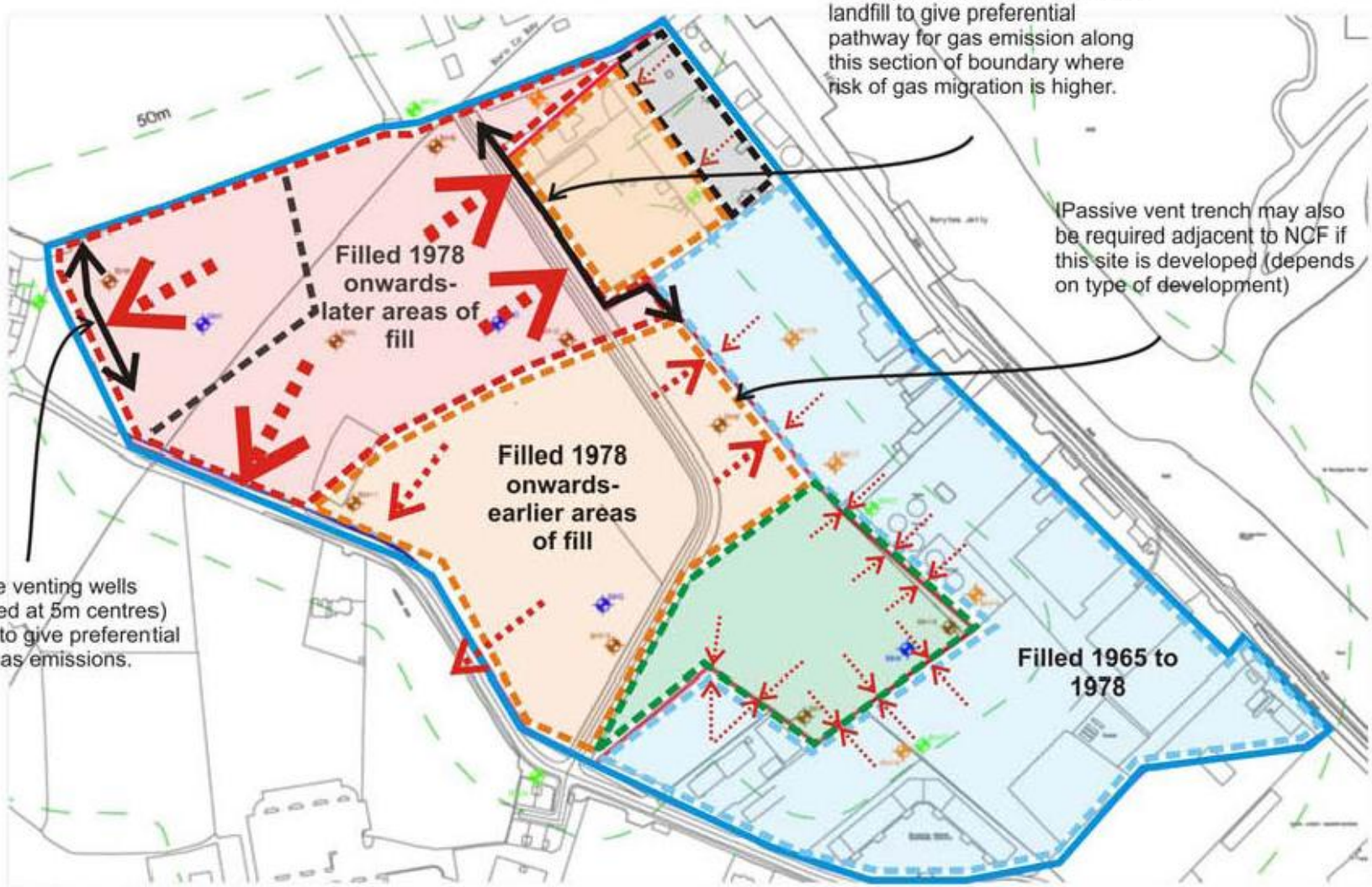
Client	Drawing
Sligo County Council	Land Ownership Boundary
Job: Former Finisklin Landfill Certificate of Authorisation Application– Screening Statement	

Job Number	Drawing Number	Status	Sht. Size	Scale	Date	Drawn
E0861	Figure 2	Final	A3	as shown	Jan 12	JA

Figure 3

Remedial options - site in current condition



Passive venting wells and trench could be combined with a biofilter to reduce greenhouse gas emissions.

APPENDIX II

I-WeBS data for Sligo Harbour and Cummeen Strand East and Gibraltar subsite, winters 2005/06 to 2009/10.

Sligo Harbour

Species	1% National	1% International	2005/06	2006/07	2007/08	2008/09	2009/10	Mean	Peak
Mute Swan	110		20	26	38	36	14	27	38
Whooper Swan	130	210				1		0	1
Light-bellied Brent Goose		260	331	663	331	543	433	460	663
Ruddy Shelduck							1	0	1
Shelduck	150	3,000	60	45	94	118	120	87	120
Wigeon	820	15,000	84	153	337	108	62	149	337
Gadwall	20	600				1		0	1
Teal	450	5,000	75	22	108	73	15	59	108
Mallard	380	20,000	156	202	185	301	148	198	301
Scaup	45	3,100				6		1	6
Long-tailed Duck	20	20,000					1	0	1
Eider	30	12,830	10			2		2	10
Common Scoter	230	16,000	120	1				24	120
Goldeneye	95	11,500	6	8	9	15	3	8	15
Red-breasted Merganser	35	1,700	23	13	35	37	23	26	37
Ruddy Duck							1	0	1
Red-throated Diver	20	3,000	3	2	4	1	6	3	6
Great Northern Diver		50	14	1	10	13	15	11	15
Little Grebe	25	4,000		3	3	2	3	2	3
Great Crested Grebe	55	3,600	2	2	20	6	7	7	20
Cormorant	140	1,200	23	16	26	16	16	19	26
Shag			21	2	15	19	4	12	21
Little Egret		1,300				1	3	1	3
Grey Heron	30	2,700	18	23	24	25	11	20	25
Oystercatcher	680	10,200	759	684	1,011	678	987	824	1,011
Ringed Plover	150	730	165	173	157	93	127	143	173
Golden Plover	1,700	9,300	350		363	654	9	275	654
Grey Plover	65	2,500	67		20	11	80	36	80
Lapwing	2,100	20,000	59	438	216	341	111	233	438
Knot	190	4,500	700	346	1,400	523	950	784	1,400
Sanderling	65	1,200	98	41	10	110		52	110
Dunlin	880	13,300	601	477	2,079	945	662	953	2,079
Snipe		20,000	9				8	3	9
Black-tailed Godwit	140	470	2	40		8	1	10	40
Bar-tailed Godwit	160	1,200	960	277	236	233	438	429	960
Curlew	550	8,500	479	297	292	529	480	415	529
Greenshank	20	2,300	8	9	16	10	9	10	16
Redshank	310	3,900	191	74	335	482	376	292	482
Turnstone	120	1,500	72	12	96	32	191	81	191
Unidentified wader sp.						35		7	35
Mediterranean Gull						1		0	1
Black-headed Gull		20,000	554	452	500	717	234	491	717
Ring-billed Gull			4		1	1		1	4
Common Gull		16,000	373	298	338	370	122	300	373
Lesser Black-backed Gull		4,500		3				1	3
Herring Gull		13,000	55	118	160	135	168	127	168
Iceland Gull					4	1	1	1	4
Glaucous Gull						7		1	7
Great Black-backed Gull		4,800	4	21	13	26	11	15	26

The counts presented in the table refer to the peak counts of species in each I-WeBS season.
Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

Cummeen Strand East and Gibraltar

Species	1% National	1% International	2005/06	2006/07	2007/08	2008/09	2009/10	Mean	Peak
Light-bellied Brent Goose		260		623	105	165	161	264	623
Ruddy Shelduck							1	0	1
Shelduck	150	3,000		45	94	117	83	85	117
Wigeon	820	15,000			283	13		74	283
Teal	450	5,000			74	50		31	74
Mallard	380	20,000		23	45	78	24	43	78
Scaup	45	3,100				6		2	6
Long-tailed Duck	20	20,000					1	0	1
Goldeneye	95	11,500					3	1	3
Red-breasted Merganser	35	1,700			18			5	18
Red-throated Diver	20	3,000			1			0	1
Great Crested Grebe	55	3,600			20			5	20
Cormorant	140	1,200		1	2			1	2
Shag					1			0	1
Little Egret		1,300					1	0	1
Grey Heron	30	2,700		4	5	1	3	3	5
Oystercatcher	680	10,200		630	694	561	631	629	694
Ringed Plover	150	730		173	157	71	127	132	173
Golden Plover	1,700	9,300				85		21	85
Grey Plover	65	2,500			3			1	3
Lapwing	2,100	20,000		22			14	9	22
Knot	190	4,500		346	1,400	520	950	804	1,400
Sanderling	65	1,200		41	10			13	41
Dunlin	880	13,300		320	1,515	780	30	661	1,515
Snipe		20,000					1	0	1
Black-tailed Godwit	140	470				7		2	7
Bar-tailed Godwit	160	1,200		276	168	222	418	271	418
Curlew	550	8,500		143	115	89	228	144	228
Greenshank	20	2,300		3	5	1	1	3	5
Redshank	310	3,900			115	210	235	140	235
Turnstone	120	1,500		6	59	13	55	33	59
Black-headed Gull		20,000		79	21	94	44	60	94
Common Gull		16,000		182	49	250	37	130	250
Herring Gull		13,000		34	14	6	15	17	34
Iceland Gull					1			0	1
Glaucous Gull						1		0	1
Great Black-backed Gull		4,800		12	1	4	1	5	12

The counts presented in the table refer to the peak counts of species in each I-WeBS season.
Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

APPENDIX III

PHOTOGRAPHS OF SITE

Plate 1. The margin of the landfill above the rock armour is now well vegetated with rank grassland and scrub (looking eastwards).

Plate 2. The lower part of the rock armour has a heavy covering of fucoid algae which extends onto the upper shore. The normal high tide mark is shown by the green algal line (looking westwards).

Plate 3. View of a seepage channel which emerges from the base of the rock armour.

Plate 4. The sediments below the rock armour are medium to fine sands. These support a typical infauna, with good numbers of lugworms.

Plate 5. View of intertidal sediments with high density of lugworm casts (looking westwards).

Plate 6. The natural shore to the west of the landfill has a wide fucoid zone and a narrow salt marsh strip.